Remarks

The amendments to the claims

Examiner will immediately see that the new claims are completely supported by the description beginning at page 6 of Applicant's Specification and the figures cited therein. The amendment to claim 20 merely changes the dependency of the claim. Applicant would like to point out at this point that the amendments are being made to obtain immediate patent protection on a process that is currently in commercial use by Applicant and are not to be construed as an admission by Applicant that no broader claims may be made. Applicant consequently reserves his right to file a divisional with broader claims than those set forth in the present amendment.

Patentability of the amended claims over Bishop and Barron

The problem solved by Applicant's invention

The technical problem solved by Applicant's invention is molding carbon fiber lugs onto joints in a carbon tube bicycle frame in a fashion which avoids discontinuities and voids in the lugs. Avoiding discontinuities and voids in the lugs is difficult because of the complex geometry of the joints: the joints involve three or four tubes joined at varying angles and it is difficult to avoid discontinuities of the carbon fiber in the joint and to compress the lay-up so that the "crotches" in the lay-up are compressed like the rest of the lay-up.

Applicant's solution to the problem has two parts:

1. making a continuous wrap of carbon fiber around the tubes--see FIGs. 9 and 10 and the discussion at page 6, lines 5-8 and the detailed discussion at page 8, line 1.
2. Using a mold that contains a silicon lining and that completely encloses the tubes and the lug to compress and cure the lug. The silicon lining is trapped between the mold and the lug. When the mold is heated, the lining expands and evenly compacts the entire lay-up, including the part of the lug that is in the crotches of the joint--see the discussion at page 6, lines 18-30.

Applicant's claims

Applicant's new independent claim 25 clearly sets forth both parts of the solution:

> **25.** (new) A method of making a lug for a joint that joins carbon fiber tubes in a bicycle frame,
> the method comprising the steps of:
> making a lay-up of at least carbon fibers and a matrix material around the tubes at the joint, *the lay-up forming a continuous wrap around the tubes*;
> applying a mold to the joint, *the applied mold's inner surface completely enclosing the lay-up and the tubes at the joint* and the inner surface having a *lining of silicon which is trapped between the inner surface and the enclosed lay-up and tubes*; and
> applying heat to the mold's interior, *the heat* causing the lay-up to cure and further *causing the trapped silicon to expand against the mold's inner surface and compact the enclosed lay-up against the tubes evenly throughout the lug*, whereby voids in the lug are prevented. (emphasis added)

The disclosures of the references

Bishop

Bishop is an example of the prior-art problems that are solved by Applicant's invention. As can be seen most clearly in FIG. 6 and described at col. 4, lines 12-26, 38-69, col. 3, line 29-col. 4, line 3, and col. 5, 1-10, Bishop's frame is glued together with fast-setting glue and a single layer of carbon fiber fabric made up of two overlapping pieces 40(a) and 40(b) is wrapped around the joined parts (col. 4, lines 38-52). The fabric sheets making up the remainder of the lay-up are laid onto into each half of Bishop's mold (col. 3, line 29-col.4, line 10. Each sheet is then worked into the part of the mold which will contain the tubes of the frame, with the sheets of lay-up extending onto the flat part if the mold, as shown in FIG. 4. The frame is then placed in one half of the mold and the other half is then placed on top of the frame and the halves are bolted together to place pressure on the lay-up. This procedure has a number of undesirable consequences.

First, Bishop's mold does not "completely enclose the lay-up and the tubes at the joint". The halves of mold 22 remain separated by the layers of fabric 40 and the filler mixture 42 when they are bolted together. Because this is the case, Bishop's mold does not exert

its force "evenly throughout the lug". Expressed in terms of FIG. 6, Bishop's molding process exerts its force horizontally but not vertically. It thus forces the layers against the sides of tube 15, but instead of forcing the layers against the top and bottom of tube 16, it forces them against each other. Consequently, there will be more compaction of the layers of the lay-up against the sides of tube 16 than at the top and bottom. The area of lesser compaction of course includes the crotches between the tubes. Moreover, because the mold does not enclose the lug and the tubes, the matrix material can escape above and below tube 16. In consequence, the force provided by the mold does not necessarily result in the matrix material being forced down into the area of the lug closest to the tube, but instead may simply force the matrix material out of the layers of fabric above and below the lug, leaving voids immediately above and below the lug.

The effect of the fact that the mold does not "completely enclose the lay-up and the tubes at the joint" is heightened by the fact that the lay-up does not "form a continuous wrap around the tubes". As can be seen in FIG. 6, all layers of fabric other than layers 40(a) and 40(b) are not wrapped around tube 16, but merely continue vertically above and below tube 16. The lug is thus held together above and below tube 16 not by the fibers of the fabric, but simply by the matrix that holds the sheets of fabric together. Moreover, because the mold does not prevent the matrix material from escaping above and below the lug, it is precisely in the area of the lug that is held together only by the matrix material where voids in the lug are most likely to occur.

Baron

What Baron discloses is a technique for molding one-piece objects made of composite materials where the object is so large that the cost of constructing a conventional mold is prohibitive. His solution is to use lightweight molding surfaces which are supported by inflated air bags. Silicon rubber blankets with heaters are placed on the molding surfaces and sheets of the composite materials are placed between the blankets. When the silicon rubber layers are heated, they expand against the molding surfaces and the composite material and provide both the pressure and temperature needed to cure the composite material. As disclosed in the reference, Baron's technique are employed to mold large

objects with simple geometries; lugs in bicycle frames are neither large nor do they have simple geometries, and it is difficult to see how Baron's techniques could be usefully applied to molding and curing lugs on carbon fiber bicycle frames.

Failure of the references to disclose the limitations of claim 25

A rejection under 35 U.S.C. 103 requires that the references show all of the limitations of the claim under rejection. As set forth above, neither Bishop nor Baron discloses the following limitations of claim 25:

- a lay-up "that form[s] a continuous wrap around the tubes";
- a mold whose "inner surface completely enclos[es] the lay-up and the tubes at the joint" and which "ha[s] a lining of silicon which is trapped between the inner surface and the enclosed lay-up and tubes";
- a mold which the effect of applying heat to the interior of the mold "caus[es] the trapped silicon to expand against the molds inner surface and compact the enclosed lay-up against the tubes evenly throughout the lug".

Since neither reference discloses any of the above limitations, the references cannot be combined to reject the claims under 35 U.S.C. 103.

It should further be expressly pointed out here that using Baron's heated silicon blankets in Bishop's mold does not result in the method of claim 25. The blankets would simply be another layer in Bishop's mold; the mold's inner surface would still not "completely enclos[e] the lay-up and the tubes at the joint", the lay-up would still not "form[] a continuous wrap around the tubes" and heating up the blankets would still not "compact the enclosed lay-up against the tubes evenly throughout the lug". In fact, adding the blankets not only does not solve the problems of Bishop's techniques, but also does not even his mold easier to use, since it would still be necessary to bolt the mold halves together in order to give the blankets something to expand against.

Patentability of the dependent claims

The dependent claims are of course patentable because the claim they are dependent from is patentable. Examiner has however already indicated that claims 20 and 23 include

limitations that are not disclosed in the references; these claims are consequently patentable in their own rights over the references. As for claim 27, the technique of tapering the lug set forth in the claim requires that the mold completely enclose the lug and the tube at the joint, and consequently is not disclosed in Bishop.

Conclusion

Applicant has shown that their claims as amended are fully supported by the application as filed and are patentable over the references. Applicant has consequently been fully responsive to Examiner's Office action of 7/21/06 as required by 37 C.F.R. 1.111(b) and Applicant consequently respectfully requests that Examiner enter the amendment and allow the claims as amended, as provided by 37 C.F.R. 1.111(a). No fees are believed to be required by way of this amendment. If any should be, please charge them to deposit account 501315

Respectfully submitted,

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10/23/06
Date